MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 (TERM ID 2210)

DSP5614 – PROBABILITY AND STATISTICS

(for diploma students only)

9 FEBRUARY 2023

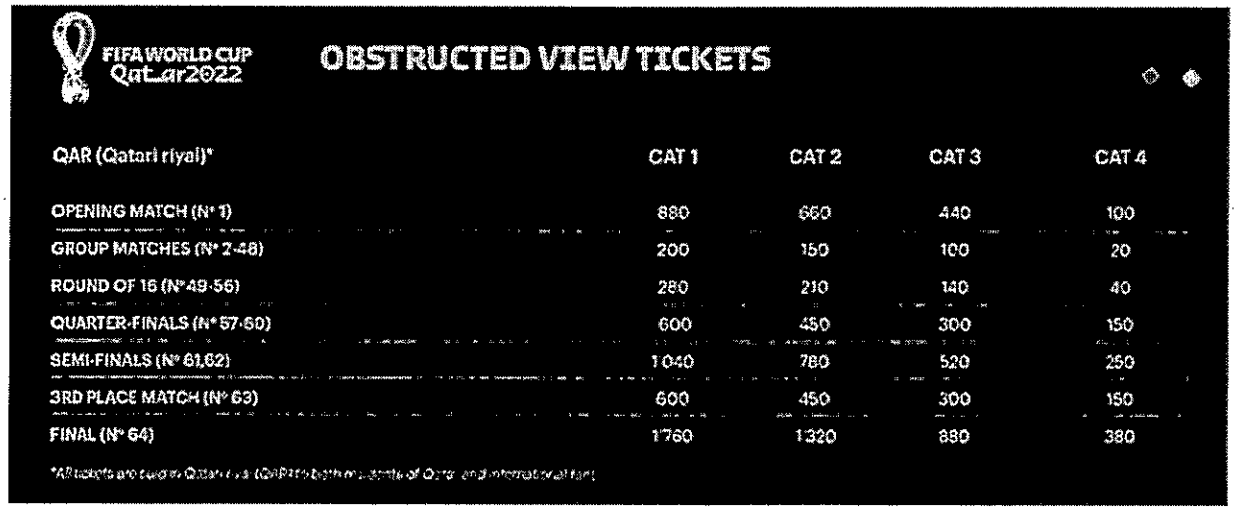
2.30 pm – 4.30 pm
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of **3** pages excluding cover page and appendix.
2. Attempt **ALL FOUR (4)** questions. The distribution of marks for each question is given.
3. Write all your answers in the Answer Booklet provided.
4. Key formulae and statistical tables are given in the Appendix.

Question 1

a) The following table shows the ticket prices for obstructed view audience of FIFA World Cup Qatar 2022.



FIFA WORLD CUP Qatar2022

OBSTRUCTED VIEW TICKETS

QAR (Qatari riyal)*	CAT 1	CAT 2	CAT 3	CAT 4
OPENING MATCH (N° 1)	880	660	440	100
GROUP MATCHES (N° 2-48)	200	150	100	20
ROUND OF 16 (N°49-56)	280	210	140	40
QUARTER-FINALS (N° 57-60)	600	450	300	150
SEMI-FINALS (N° 61,62)	1040	780	520	250
3RD PLACE MATCH (N° 63)	600	450	300	150
FINAL (N° 64)	1760	1320	880	380

*All tickets are [illegible]

Source: *https://www.fifa.com/fifaplus/en/articles/ticket-prices-en*

i. Identify the 5-number summary. (5 marks)
ii. Find the lower and upper limit. (3 marks)
iii. Construct and label the boxplot. (3 marks)
iv. Identify the adjacent values and outlier. (3 marks)

b) Table below shows the number of seats available in eight stadiums during the FIFA World Cup Qatar 2022. Calculate the mean and sample standard deviation. (6 marks)

Stadium name	Lusail	Al Bayt	Al Janoub	Ahmed Ali	Khalifa	Education city	Stadium 974	Al Thumama
Seat capacity	80,000	60,000	40,000	40,000	40,000	40,000	40,000	40,000

Source: *https://www.stadiumguide.com/tournaments/fifa-world-cup-2022-stadiums-qatar/*

[TOTAL: 20 MARKS]

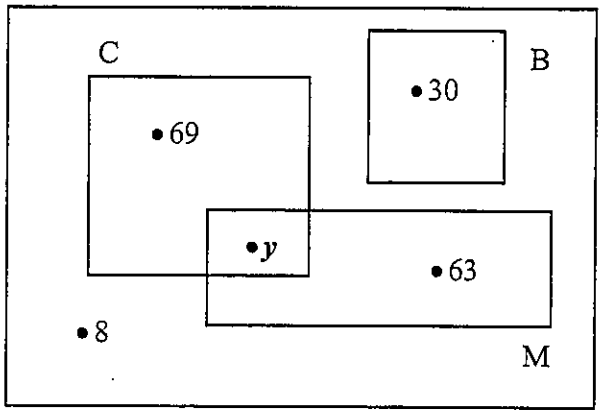
Question 2

a) Temenggung Emas company is planning for a new product launching. The manager of the company estimates that the probability of good market conditions is 70%. If the market conditions are good, the probability of a successful launch is 65% and if the market conditions are poor, the probability of a successful launch is 55%.

i. Determine the percentage of a successful launch. (5 marks)
ii. If the product is unsuccessful, find the probability that the market conditions were poor. (4 marks)
iii. Find the probability either good or poor market conditions. (3 marks)

Continued...

b) A total of 200 respondents have involved during the saving awareness campaign conducted by AKPK. It is found that three prominent banks which has high number of sign-up accounts; CIMB – C, Maybank – M and BSN – B. The information is represented in the following Venn Diagram. One respondent is chosen at random.



i. Identify the value of y. (2 marks)

ii. Find $P(C)$, $P(M)$ and $P(B)$. (3 marks)

iii. What is the percentage of a respondent who has sign-up either BSN or Maybank account? (4 marks)

iv. Find the probability of $P(C \cup M \cup B)'$. (2 marks)

v. Are the events *CIMB* and *Maybank* mutually exclusive? State your reason. (2 marks)

[TOTAL: 25 MARKS]

Question 3

a) In a Hackaton competition organized by Amato institution, it is shown that Team Mechanize score is lower compared to Team Mechabot. The table below summarize the data from the competition. Test the claim at $\alpha = 0.10$. (10 marks)

	Team Mechanize	Team Mechabot
Sample mean	147	155
Population variance	900	900
Sample	50	50

b) A random sample of 100 students has been selected and found their average amount of PTPTN loan is RM7250 per year. This is said to be more than the previous average of RM6800 per year. The data is assumed to be normally distributed with a population standard deviation of RM1800.

Source: *https://afterschool.my/ptptn-guides/how-much-loan-does-ptptn-offer*

i. Identify the *Ho* and *Ha*. (2 marks)

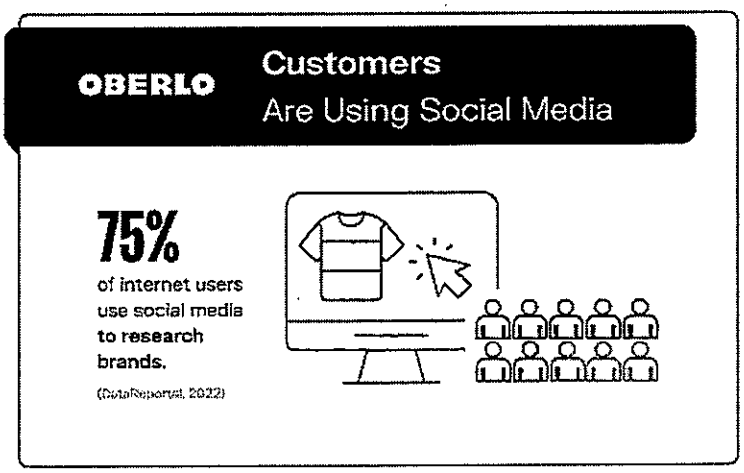
ii. Compute the value of test-statistics. (3 marks)

iii. What is the *p-value*? (2 marks)

iv. Test the claim at 5% significance level. (3 marks)

Continued...

c) The following article shows that 75% of internet users use social media to research brand. Based on the recent report, only 370 out of 500 internet users use social media to research brand. Does this imply that the population proportion of internet users has been changed? Test the claim at 5% significance level. (10 marks)



Source: *https://my.oberlo.com/blog/social-media-marketing-statistics*

[TOTAL: 30 MARKS]

Question 4

A trainee is preparing a report to see the relationship between the number of missed classes and the exam scores for eight students in one rural school. He presented the data in the following table.

Number of missed classes	1	6	5	2	4	3	1	5
Exam score	87	30	50	65	Q	57	75	42

a) Find the value of Q if the Σy is 456. (2 marks)
b) According to the table above, find the value of S_{xx} , S_{yy} and S_{xy}. (9 marks)
c) Compute the correlation coefficient, r and interpret the answer. (4 marks)
d) Find the linear regression equation $\hat{y} = \beta_0 + \beta_1 x$. (6 marks)
e) Compute the value of *SST*, *SSR* and *SSE*. (4 marks)

[TOTAL: 25 MARKS]

End of Paper.

APPENDIX – KEY FORMULA

	Ungrouped Data	Grouped Data
Mean	$\bar{x} = \frac{\sum x}{n}$ where n : sample size	$\bar{x} = \frac{\sum mf}{\sum f}$ where m : class midpoint f : class frequency
Variance	$s^2 = \frac{1}{n-1}\left[\sum x^2 - \frac{(\sum x)^2}{n}\right]$ where n : sample size	$s^2 = \frac{1}{(\sum f)-1}\left[\sum m^2 f - \frac{(\sum mf)^2}{\sum f}\right]$ where m : class midpoint f : class frequency

NORMAL AND STANDARD NORMAL PROBABILITY DISTRIBUTION

- z-value (observed value) for an x value : $Z = \frac{x-\mu}{\sigma}$

HYPOTHESIS TESTING

Population	Mean	Proportion
1	$Z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}}$	$Z = \frac{\hat{p} - p_0}{\sqrt{\frac{p_0(1-p_0)}{n}}}$ where $\hat{p} = \frac{x}{n}$
2	$Z = \frac{(\bar{x}_1 - \bar{x}_2) - (\mu_1 - \mu_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}}$	$Z = \frac{(\hat{p}_1 - \hat{p}_2) - (p_1 - p_2)}{\sqrt{\hat{p}_p(1-\hat{p}_p)}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$ where $\hat{p}_p = \frac{x_1 + x_2}{n_1 + n_2}$

REGRESSION

- **Least square regression equation,** $\hat{y} = \beta_0 + \beta_1 x$

  where $\beta_1 = \frac{S_{xy}}{S_{xx}}$ and $\beta_0 = \frac{1}{n}[\sum y - (\beta_1 . \sum x)]$

- **Correlation coefficient,** $r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}}$ where

$S_{xx} = \sum x^2 - \frac{(\sum x)^2}{n}$	$S_{yy} = \sum y^2 - \frac{(\sum y)^2}{n}$	$S_{xy} = \sum xy - \frac{(\sum x)(\sum y)}{n}$

- **Sum of Square**

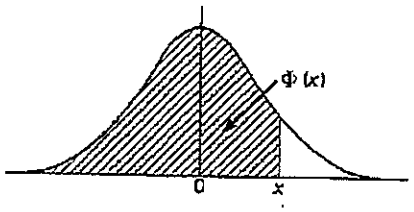
$SST = SSR + SSE$	$SST = S_{yy}$	$SSR = \frac{(S_{xy})^2}{S_{xx}}$

- **Regression t-Test**

Standard Error, $s_e = \sqrt{\frac{SSE}{n-2}}$	Regression t-Test $t = \frac{\beta_1}{s_e / \sqrt{Sxx}}$	Correlation t-Test $t = r \cdot \sqrt{\frac{n-2}{1-r^2}}$

TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

The function tabulated is $\Phi(x) = \frac{1}{\sqrt{2\pi}} \int_{-\infty}^{x} e^{-\frac{1}{2}t^2}\, dt$. $\Phi(x)$ is the probability that a random variable, normally distributed with zero mean and unit variance, will be less than or equal to x. When $x < 0$ use $\Phi(x) = 1 - \Phi(-x)$, as the normal distribution with zero mean and unit variance is symmetric about zero.



x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
0·00	0·5000	0·40	0·6554	0·80	0·7881	1·20	0·8849	1·60	0·9452	2·00	0·97725
·01	·5040	·41	·6591	·81	·7910	·21	·8869	·61	·9463	·01	·97778
·02	·5080	·42	·6628	·82	·7939	·22	·8888	·62	·9474	·02	·97831
·03	·5120	·43	·6664	·83	·7967	·23	·8907	·63	·9484	·03	·97882
·04	·5160	·44	·6700	·84	·7995	·24	·8925	·64	·9495	·04	·97932
0·05	0·5199	0·45	0·6736	0·85	0·8023	1·25	0·8944	1·65	0·9505	2·05	0·97982
·06	·5239	·46	·6772	·86	·8051	·26	·8962	·66	·9515	·06	·98030
·07	·5279	·47	·6808	·87	·8078	·27	·8980	·67	·9525	·07	·98077
·08	·5319	·48	·6844	·88	·8106	·28	·8997	·68	·9535	·08	·98124
·09	·5359	·49	·6879	·89	·8133	·29	·9015	·69	·9545	·09	·98169
0·10	0·5398	0·50	0·6915	0·90	0·8159	1·30	0·9032	1·70	0·9554	2·10	0·98214
·11	·5438	·51	·6950	·91	·8186	·31	·9049	·71	·9564	·11	·98257
·12	·5478	·52	·6985	·92	·8212	·32	·9066	·72	·9573	·12	·98300
·13	·5517	·53	·7019	·93	·8238	·33	·9082	·73	·9582	·13	·98341
·14	·5557	·54	·7054	·94	·8264	·34	·9099	·74	·9591	·14	·98382
0·15	0·5596	0·55	0·7088	0·95	0·8289	1·35	0·9115	1·75	0·9599	2·15	0·98422
·16	·5636	·56	·7123	·96	·8315	·36	·9131	·76	·9608	·16	·98461
·17	·5675	·57	·7157	·97	·8340	·37	·9147	·77	·9616	·17	·98500
·18	·5714	·58	·7190	·98	·8365	·38	·9162	·78	·9625	·18	·98537
·19	·5753	·59	·7224	·99	·8389	·39	·9177	·79	·9633	·19	·98574
0·20	0·5793	0·60	0·7257	1·00	0·8413	1·40	0·9192	1·80	0·9641	2·20	0·98610
·21	·5832	·61	·7291	·01	·8438	·41	·9207	·81	·9649	·21	·98645
·22	·5871	·62	·7324	·02	·8461	·42	·9222	·82	·9656	·22	·98679
·23	·5910	·63	·7357	·03	·8485	·43	·9236	·83	·9664	·23	·98713
·24	·5948	·64	·7389	·04	·8508	·44	·9251	·84	·9671	·24	·98745
0·25	0·5987	0·65	0·7422	1·05	0·8531	1·45	0·9265	1·85	0·9678	2·25	0·98778
·26	·6026	·66	·7454	·06	·8554	·46	·9279	·86	·9686	·26	·98809
·27	·6064	·67	·7486	·07	·8577	·47	·9292	·87	·9693	·27	·98840
·28	·6103	·68	·7517	·08	·8599	·48	·9306	·88	·9699	·28	·98870
·29	·6141	·69	·7549	·09	·8621	·49	·9319	·89	·9706	·29	·98899
0·30	0·6179	0·70	0·7580	1·10	0·8643	1·50	0·9332	1·90	0·9713	2·30	0·98928
·31	·6217	·71	·7611	·11	·8665	·51	·9345	·91	·9719	·31	·98956
·32	·6255	·72	·7642	·12	·8686	·52	·9357	·92	·9726	·32	·98983
·33	·6293	·73	·7673	·13	·8708	·53	·9370	·93	·9732	·33	·99010
·34	·6331	·74	·7704	·14	·8729	·54	·9382	·94	·9738	·34	·99036
0·35	0·6368	0·75	0·7734	1·15	0·8749	1·55	0·9394	1·95	0·9744	2·35	0·99061
·36	·6406	·76	·7764	·16	·8770	·56	·9406	·96	·9750	·36	·99086
·37	·6443	·77	·7794	·17	·8790	·57	·9418	·97	·9756	·37	·99111
·38	·6480	·78	·7823	·18	·8810	·58	·9429	·98	·9761	·38	·99134
·39	·6517	·79	·7852	·19	·8830	·59	·9441	·99	·9767	·39	·99158

TABLE 4. THE NORMAL DISTRIBUTION FUNCTION

x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$	x	$\Phi(x)$
2·40	0·99180	2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918
·41	·99202	·56	·99477	·71	·99664	·86	·99788	·01	·99869	·16	·99921
·42	·99224	·57	·99492	·72	·99674	·87	·99795	·02	·99874	·17	·99924
·43	·99245	·58	·99506	·73	·99683	·88	·99801	·03	·99878	·18	·99926
·44	·99266	·59	·99520	·74	·99693	·89	·99807	·04	·99882	·19	·99929
2·45	0·99286	2·60	0·99534	2·75	0·99702	2·90	0·99813	3·05	0·99886	3·20	0·99931
·46	·99305	·61	·99547	·76	·99711	·91	·99819	·06	·99889	·21	·99934
·47	·99324	·62	·99560	·77	·99720	·92	·99825	·07	·99893	·22	·99936
·48	·99343	·63	·99573	·78	·99728	·93	·99831	·08	·99896	·23	·99938
·49	·99361	·64	·99585	·79	·99736	·94	·99836	·09	·99900	·24	·99940
2·50	0·99379	2·65	0·99598	2·80	0·99744	2·95	0·99841	3·10	0·99903	3·25	0·99942
·51	·99396	·66	·99609	·81	·99752	·96	·99846	·11	·99906	·26	·99944
·52	·99413	·67	·99621	·82	·99760	·97	·99851	·12	·99910	·27	·99946
·53	·99430	·68	·99632	·83	·99767	·98	·99856	·13	·99913	·28	·99948
·54	·99446	·69	·99643	·84	·99774	·99	·99861	·14	·99916	·29	·99950
2·55	0·99461	2·70	0·99653	2·85	0·99781	3·00	0·99865	3·15	0·99918	3·30	0·99952

The critical table below gives on the left the range of values of x for which $\Phi(x)$ takes the value on the right, correct to the last figure given; in critical cases, take the upper of the two values of $\Phi(x)$ indicated.

3·075	0·9990	3·263	0·9994	3·731	0·99990	3·916	0·99995
3·105	0·9991	3·320	0·9995	3·759	0·99991	3·976	0·99996
3·138	0·9992	3·389	0·9996	3·791	0·99992	4·055	0·99997
3·174	0·9993	3·480	0·9997	3·826	0·99993	4·173	0·99998
3·215	0·9994	3·615	0·9998	3·867	0·99994	4·417	0·99999
			0·9999		0·99995		1·00000

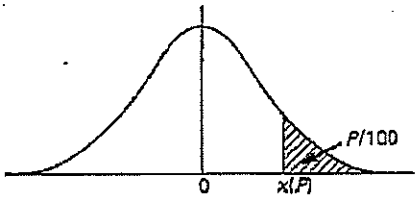
When $x > 3{\cdot}3$ the formula $1-\Phi(x) \doteqdot \frac{e^{-\frac{1}{2}x^2}}{x\sqrt{2\pi}}\left[1-\frac{1}{x^2}+\frac{3}{x^4}-\frac{15}{x^6}+\frac{105}{x^8}\right]$ is very accurate, with relative error less than $945/x^{10}$.

TABLE 5. PERCENTAGE POINTS OF THE NORMAL DISTRIBUTION

This table gives percentage points $x(P)$ defined by the equation

$$\frac{P}{100} = \frac{1}{\sqrt{2\pi}}\int_{x(P)}^{\infty} e^{-\frac{1}{2}t^2}\,dt.$$

If X is a variable, normally distributed with zero mean and unit variance, $P/100$ is the probability that $X \geqslant x(P)$. The lower P per cent points are given by symmetry as $-x(P)$, and the probability that $|X| \geqslant x(P)$ is $2P/100$.



P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$	P	$x(P)$
50	0·0000	5·0	1·6449	3·0	1·8808	2·0	2·0537	1·0	2·3263	0·10	3·0902
45	0·1257	4·8	1·6646	2·9	1·8957	1·9	2·0749	0·9	2·3656	0·09	3·1214
40	0·2533	4·6	1·6849	2·8	1·9110	1·8	2·0969	0·8	2·4089	0·08	3·1559
35	0·3853	4·4	1·7060	2·7	1·9268	1·7	2·1201	0·7	2·4573	0·07	3·1947
30	0·5244	4·2	1·7279	2·6	1·9431	1·6	2·1444	0·6	2·5121	0·06	3·2389
25	0·6745	4·0	1·7507	2·5	1·9600	1·5	2·1701	0·5	2·5758	0·05	3·2905
20	0·8416	3·8	1·7744	2·4	1·9774	1·4	2·1973	0·4	2·6521	0·01	3·7190
15	1·0364	3·6	1·7991	2·3	1·9954	1·3	2·2262	0·3	2·7478	0·005	3·8906
10	1·2816	3·4	1·8250	2·2	2·0141	1·2	2·2571	0·2	2·8782	0·001	4·2649
5	1·6449	3·2	1·8522	2·1	2·0335	1·1	2·2904	0·1	3·0902	0·0005	4·4172